CDU-720 SINGLE-ENDED

CDU-722 SINGLE-ENDED/DIFFERENTIAL

INTELLIGENT SYNC/ASYNC

UNIBUS SCSI HOST ADAPTER

CMD TECHNOLOGY, INC.

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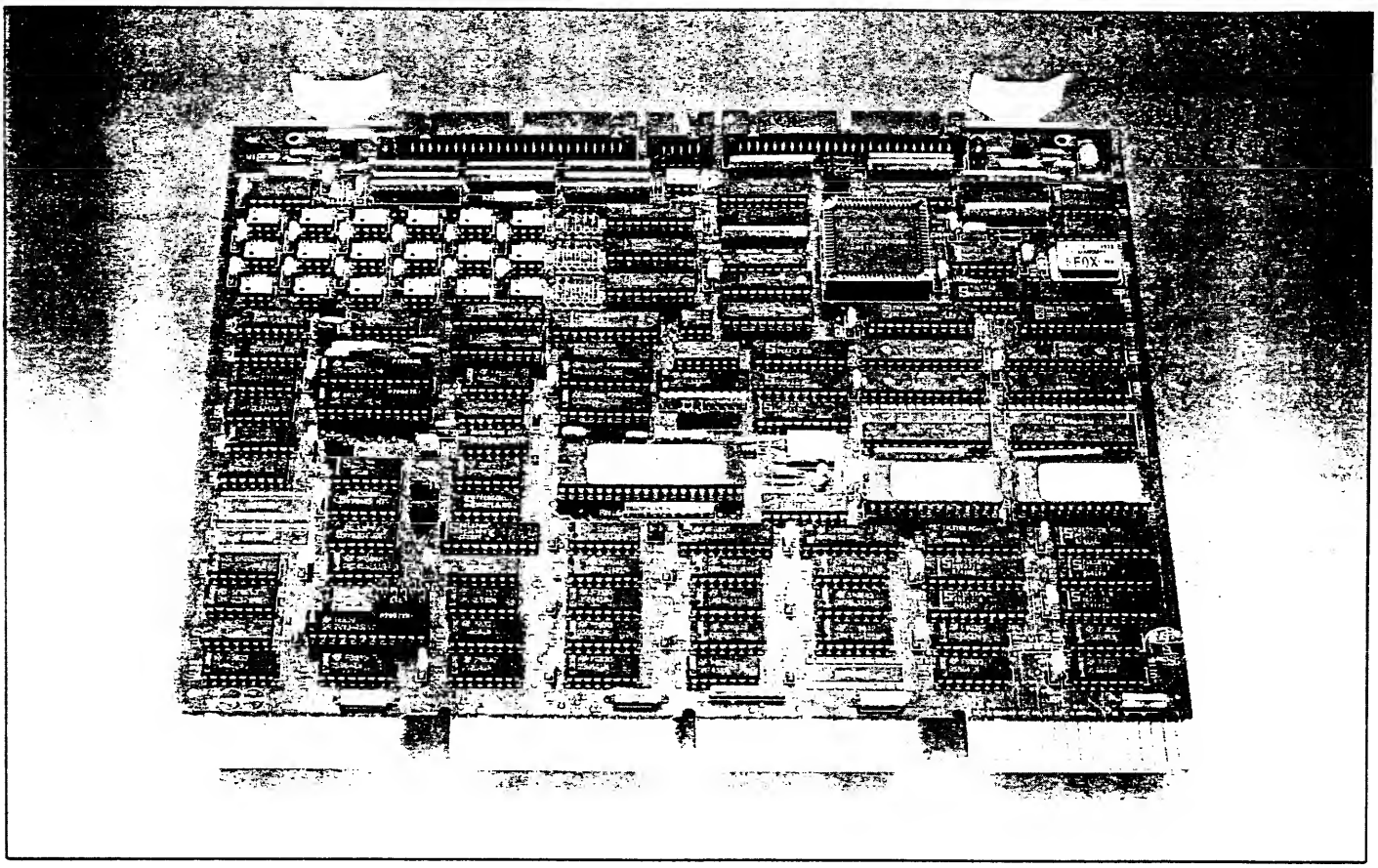
Irvine, CA 92718
(714) 454-0800

CDU-720 Rev 1.1
Nov. 27, 1990

CDU

720/722 SERIES
UNIBUS SYNC/ASYNC SCSI HOST ADAPTER
SINGLE-ENDED DIFFERENTIAL
CABLE LENGTH UP TO 80 FT.



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FCC WARNING

This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the technical manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against such interference when operating in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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CHAPTER 1 INTRODUCTION

CDU-720 , CDU-722 UNIBUS SYNC/ASYNC SCSI DISK/TAPE CONTROLLER

The CDU-720 is an intelligent quad-wide Unibus Sync/Async SCSI host adapter which is fully compatible with the DEC Mass Storage Control Protocol (MSCP) and the DEC Tape Mass Storage Control Protocol (TMSCP).

The CDU-720 can be used with the PDP-11/84, PDP-11/70, PDP-11/44, PDP 11/34, PDP 11/24, VAX 11/730, VAX 11/750, VAX 11/780, VAX 8250, VAX 8350, VAX 8550, VAX 8600, VAX 8800 and other DEC computers with a UNIBUS. It supports RSX, RSTS, VMS, UNIX, ULTRIX, DSM-11, and other operating systems which use the DU/MU drivers.

The CDU-720 supports virtual (infinite) data buffer, command queuing, standard SCSI bus arbitration, disconnect and reconnect, and SCSI common command set (CCS). Up to seven single-ended SCSI target devices (magnetic disk and tape) can be connected to CDU-720 with SCSI bus data transfer rate up to 4.8M bytes per second in synchronous mode and 3 M bytes per second in asynchronous mode.

The CDU-720 supports a variety of SCSI devices including magnetic disk, magnetic tape and optical disk drives. The CDU-720/M is the SCSI host adapter that supports disk drives only. The CDU-720/T is the SCSI host adapter that supports tape drives only. The CDU-720/TM supports both disk and tape drives, etc.

The CDU-720 has six different variations in line - Standard CDU-720/M, CDU-720/T, CDU-720/TM, Jukebox version CDU-720/TMJ, Pass-thru version CDU-720/TMP and Shadow version CDU-720/TMS.

(Note: Unless otherwise specified, the CDU-720 will represent all of the six variations throught this manual.)

The CDU-720/M and CDU-720/TM have an on-board utility for users to format and configure the SCSI devices, scan bad blocks and replace them automatically. It also contains a user selectable bootstrap option which can boot up the system on power up or reset. The CDU-720/T and CDU-720/TM have an on-board utility for users to boot up the system from tape or exercise the tape devices.

The CDU-720 has an on-board non-volatile RAM (NOVRAM) to store the drive Logical Unit Number Offset and other important information of the drives.

The CDU-720 comes standard with an installation manual and one year warranty.

The CDU-722 consists of CDU-720 and on-board differential SCSI drivers and receivers. Users can select either single-ended mode or differential mode. When the CDU-722 is set to the differential mode, up to 7 SCSI differential devices can be connected to the host adapter. Please refer to section 3.2.2 for details.

CHAPTER 2 CDU-720,CDU-722 SPECIFICATIONS

2.1 UNIBUS CONTROLLER SPECIFICATIONS:

Emulation	DISK:	MSCP (DU driver)
	TAPE:	TMSCP (MU driver, same as TK50 and TU81)
CSR Address:		
CDU-720/M (Disk only) IC P72009A (U102)		772150, 760334, 760354, 760374, 760340, 760344, 760350, 760360 and up to 29 CSR addresses
CDU-720/T (Tape only) IC P72010A (U102)		774500, 760404, 760444, 760504, 760544, 760410, 760450, 760454 and up to 31 CSR addresses
CDU-720/TM (Disk and Tape) IC P72008A (U102)		772150, 760334, 760354, 760374, 760340, 760334, 760350, disable disk 774500, 760404, 760444, 760504, 760544, 760410, 760450, disable tape
Interrupt Vector:		Software programmable
Command Queuing:		Commands with optimized seek
Data Buffer Capacity:		Virtual data buffer (infinite size)
Bootstrap:		Auto bootstrap or utility bootstrap
Defect Management:		Dynamic defect management
Software Supported:		All standard DEC operating systems
Multiple-Hosting:		Support multiple-hosting for disks, optical drives and tapes.
Formatting:		On board format and bad block replacement (ISO standard for optical erasable disk format)
Partitioning:		2 or 4 equally divided partitions for disk drives
Shadowing:		Any two disk drives on the bus can form a shadow set (for /TMS version only)
Optional Software:		Tape monitor utility (TMU) SCSIformat ON-LINE (FMT) SCSI Library Manager (SLM for /TMJ only) Generic SCSI Adapter (GSA for /TMP only)
LED Indicators:		Self test, error conditions

Peripheral Interface:	Small Computer System Interface (SCSI)
Devices Supported:	Up to 7 SCSI devices CDU-720/T 7 Tape Dives CDU-720/M 7 Disk Drives CDU-720/TM 7 Disk/Tape Drives combined
System Performance:	Support disconnect/reconnect and multiple host configuration
SCSI Transfer Rate:	4.8MB/sec Synchronous mode 3.0MB/sec Asynchronous mode
SCSI Bus Parity:	Odd parity
SCSI Driver/receiver:	CDU-720 supports Single-ended CDU-722 supports Single-ended/Differential
SCSI Cable Length:	CDU-720 up to 6 meters (Single-ended) CDU-722 up to 25 meters (Differential)
Operating Temperature:	5 C to 50 C
Relative Humidity:	10% to 90%, Non-condensing
Power Requirement:	+5V DC, 2.8A

CHAPTER 3 INSTALLATION

3.1 Installation Note Under VMS

The first step to install the CDU-720 SCSI host adapter under the VMS operating system is to determine the Control and Status Register (CSR) address of the CDU-720. For the CDU-720/M or CDU-720/T, only one CSR address is required. For the CDU-720/TM, two CSR addresses are required. The following procedure shows one method of determining the new CSR address of the CDU-720.

Do not install the new CDU-720 in the system until the CSR address is determined.

First boot the VMS system and log into the system manager account.

At the DCL $ prompt, enter MC SYSGEN

At the prompt SYSGEN>, enter SHOW/CONFIG. The SYSGEN utility will display all the device controllers installed in the system and their corresponding CSR addresses and vectors. Make a note of the list.

At the prompt SYSGEN>, enter CONFIG

At the prompt DEVICE>, for CDU-720/M, enter UDA X where X is the number of installed UDA type controllers plus 1 (for the new one being added). For CDU-720/T, enter TU81 Y where Y is the number of installed TU81 type controllers plus 1 (for the new one being added). For CDU-720/TM, enter UDA X <CR> and TU81 Y <CR> where X and Y are the numbers defined above.

At the prompt DEVICE>, enter CONTROL Z. The SYSGEN utility will display the CSR addresses for all the controllers. The VMS mnemonic for the MSCP disk controllers are PUA, PUB, PUC, etc. The VMS mnemonic for the TMSCP tape controllers are PTA, PTB, PTC , etc. Please use the corresponding CSR address to configure the CSR jumper settings of the CDU-720. If the CSR address is not on the support list, please consult CMD.

At the prompt SYSGEN>, enter CONTROL Z to exit the SYSGEN utility.

Note that the CDU-720 will automatically program the on-board interrupt vector to match the vector assigned by the system. The vectors of DHV11 or other controllers might change when the CDU-720 is added to the system.

An example of the SYSGEN utility procedure is provided for installing the CDU-720/TM in VMS system.

```
$ MC SYSGEN

SYSGEN> SHOW/CONFIG

         System CSR and VECTOR on 2-JUN-1989 04:10:43.30

Name: PUA Units:1  Nexus:0 (UBA) CSR:772150 Vector:774  Vector2:0
Name: PTA Units:1  Nexus:0 (UBA) CSR:774500 Vector:260  Vector2:0
Name: PUB Units:1  Nexus:0 (UBA) CSR:760334 Vector:300  Vector2:0

SYSGEN> CONFIG
DEVICE> UDA 3
DEVICE> TU81 2
DEVICE> ^Z

Device: UDA  Name: PUA   CSR: 772150  Vector:154  Support: Y
Device: TU81 Name: PTA   CSR: 774500  Vector:260  Support: Y
Device: UDA  Name: PUB   CSR: 760334* Vector:300* Support: Y
Device: UDA  Name: PUC   CSR: 760340* Vector:304* Support: Y
Device: TU81 Name: PTB   CSR: 760444* Vector:310* Support: Y

SYSGEN> ^Z
$
```

In this example the CSR addresses of PUC and PTB should be used to configure the CSR jumpers of the CDU-720/TM.

3.2 CDU-720 Jumper Settings

3.2.1 CSR Address Selection

The CDU-720 has jumpers to select different CSR addresses. Select the desired address by installing the jumper plugs. The standard CSR address for the CDU-720/M disk SCSI host adapter is 772150. The standard CSR address for the CDU-720/T tape SCSI host adapter is 774500. The standard CSR addresses for the CDU-720/TM disk and tape SCSI host adapter are 772150 and 774500. Please refer to Figure 1 for jumper locations.

The CDU-720/M (with the IC P72009A in U102) supports 29 disk CSR addresses. Only 8 disk CSR addresses are shown in the following table. Please refer to the Appendix 4 for other CSR addresses.

Address	PDP-11	W11	W12	W13	W14	W15
1	772150	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	760334	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
3	760354	1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
4	760374	1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN
5	760340	2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
6	760344	2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
7	760350	2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN
8	760360	2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN

The CDU-720/T (with the IC P72010A in U102) supports 31 tape CSR addresses. Only 8 tape CSR addresses are shown in the following table. Please refer to the Appendix 5 for other CSR addresses.

Address	PDP-11	W12	W13	W14	W15	W16
1	774500	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN
2	760404	1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN
3	760444	1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN
4	760504	1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN
5	760544	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN
6	760410	1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN
7	760450	1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN
8	760454	1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN

The CDU-720/TM (with the IC P72008A in U102) supports 7 disk and 7 tape CSR addresses. The CSR jumper settings are shown in the following table.

The 7 disk CSR jumper settings:

Address	PDP-11	W11	W12	W13
1	772150	1-2 IN	1-2 IN	1-2 IN
2	760334	1-2 IN	1-2 IN	2-3 IN
3	760354	1-2 IN	2-3 IN	1-2 IN
4	760374	1-2 IN	2-3 IN	2-3 IN
5	760340	2-3 IN	1-2 IN	1-2 IN
6	760344	2-3 IN	1-2 IN	2-3 IN
7	760350	2-3 IN	2-3 IN	1-2 IN
8	disable disk	2-3 IN	2-3 IN	2-3 IN

The 7 tape CSR jumper settings:

Address	PDP-11	W14	W15	W16
1	774500	1-2 IN	1-2 IN	1-2 IN
2	760404	1-2 IN	1-2 IN	2-3 IN
3	760444	1-2 IN	2-3 IN	1-2 IN
4	760504	1-2 IN	2-3 IN	2-3 IN
5	760544	2-3 IN	1-2 IN	1-2 IN
6	760410	2-3 IN	1-2 IN	2-3 IN
7	760450	2-3 IN	2-3 IN	1-2 IN
8	disable tape	2-3 IN	2-3 IN	2-3 IN

If users require other CSR addresses than listed, please cousult CMD Technology.

3.2.2 Single-ended or Differential Mode Selection

When 3 jumper shunts are installed in W20, W21, and W22 pin 2-3 locations, single-ended SCSI drivers and receivers and single-ended protection circuits are enabled. When 3 jumper shunts are installed in W20, W21, and W22 pin 1-2 locations, the differential drivers and receivers and differential protection circuits are enabled.

The CDU-720 comes with single-ended SCSI drivers and receivers and 3 jumper shunts installed in W20, W21, and W22 pin 2-3 locations. The connector J1 is used for single-ended SCSI connection.

The CDU-722 comes with both single-ended and differential SCSI drivers and receivers. 3 jumper shunts are installed in W20, W21, and W22 pin 2-3 locations, i.e. single-ended mode is selected. The connector J2 is used for differential SCSI. Users who want to use CDU-722 in differential mode need to install 3 jumper shunts in W20, W21, and W22 pin 1-2 locations , disconnect the single-ended target devices from the connector J1 and connect the differential target devices to the connector J2 of the CDU-722. Whem power is applied to the CDU-722, the corresponding green LED right next to the selected SCSI connector will be turned on. Please refer to section 3.1.8 for LED indications and Figure 1 for SCSI connectors. Normally, the power on/off protection selection is jumpered to match the SCSI mode selected. Please refer to section 3.1.10.

3.2.3 SCSI Host Adapter (Initiator) ID Selection

Each device (Initiator or Target) on the SCSI bus requires an unique SCSI Identification address (0-7). SCSI ID 7 has the highest priority on the bus. SCSI ID 0 has the lowest priority on the bus. The SCSI Host Adapter of CDU-720 is factory configured to SCSI ID 7. To alter the Host Adapter SCSI ID, users need to change jumper setting of W6-1, W6-2, and W6-3.

W6-1	W6-2	W6-3	Initiator ID
IN	IN	IN	7 highest priority
IN	IN	OUT	6
IN	OUT	IN	5
IN	OUT	OUT	4
OUT	IN	IN	3
OUT	IN	OUT	2
OUT	OUT	IN	1
OUT	OUT	OUT	0 lowest priority

Note: Do not have more than one device on the SCSI bus with the same SCSI ID. The host adapter is normally set to a higher priority than the drives on the SCSI bus.

3.2.4 SCSI Terminator Power Option

When the power of the SCSI device with the SCSI terminators is turned off, the SCSI signals will be pulled down unless the terminators are powered by other SCSI device, typically an initiator (SCSI host adapter).

The CDU-720 supplies terminator power to the TERMPWR pin (pin 26) of single-ended SCSI connector (J1) through a diode, a fuse and jumper block W3 for external SCSI drives. In order to prevent accidental grounding or misconnection of terminator power, no jumper shunt is installed in W3 location. To use this option, users should add a jumper shunt in W3 location. Please make sure that the pin 1 mark of SCSI cable matches with the pin 1 mark of SCSI device's connector before turning on the system power.

W3	OUT	Single-ended SCSI terminator power disabled
W3	IN	Single-ended SCSI terminator power enabled

The CDU-722 also supplies terminator power to the TERMPWR pins (pin 25 and pin 26) of differential SCSI connector (J2) through a diode, a fuse and jumper block W2 for external SCSI drives. In order to prevent accidental grounding or misconnection of terminator power, no jumper shunt is installed in W2 location. To use this option, users should add a jumper shunt in W2 location. Please make sure that the pin 1 mark of SCSI cable matches with the pin 1 mark of SCSI device's connector before turning on the system power.

W2	OUT	Differential SCSI terminator power disabled
W2	IN	Differential SCSI terminator power enabled

Please note that when external SCSI terminator is used in the disk/tape subsystem, the CDU-720 or CDU-722 terminator power option needs to be enabled.

3.2.5 Tape Fast Search Option

When set to the Tape Fast Search mode, the controller will enable high speed forward and reverse filemark search. VMS may use this mode if the user does not attempt a standalone boot or run other programs that require the controller to keep track of the number of data records between filemarks. In VMS standalone boot application, this option need to be disabled. For the ISM-11 operating system, this option need to be enabled.

W6-4	OUT	Disable Tape Fast Search
	IN	Enable Tape Fast Search

3.2.6 Auto-Boot Enable Selection

For PDP-11 disk users only, the CDU-720 may be set to provide an auto-bootstrap at 771000 or 773000 on power up or whenever the "Boot" switch is pressed. The auto-bootstrap may be enabled by installing a jumper shunt in jumper block W5 pin 2 and pin 3.

W5	2-3 IN	Auto-Boot enabled
	1-2 IN	Auto-Boot disabled
W10	2-3 IN	Bootstrap address = 771000
	1-2 IN	Bootstrap address = 773000

If enabled, the bootstrap ROM at 771000 (or 773000) on the CDU-720 will load the boot block to memory. The boot program then bootstraps the operating system. Please make sure that there is no existing boot ROM at that address selected by W10. The controller will only auto-boot DU0: at CSR 772150. To boot other devices use Utility boot. (see section on Utility Boot)

3.2.7 Sync/Async Mode Selection

In general, the Sync/Async Mode for each individual drive can be selected through the on-board utility individually. The default setting is synchronous mode.

In sync mode, CDU-720 will automatically communicate with the SCSI device to find out the sync mode is possible or only the async mode is supported by the device, then it will switch mode automatically thereafter. For those devices which do not even support this communication, async mode should be used to insure proper operation, e.g. M4 data.

The following jumpers are controlling the overall Sync/Async mode selection and will override the on-board utility sync mode set-up.

W10-1	IN	Tape sync mode disabled
	OUT	Tape sync mode enabled (factory)
W10-2	IN	Disk sync mode disabled
	OUT	Disk sync mode enabled (factory)

3.2.8 Power On/Off Protection

The CDU-720/722 is designed with special circuits to protect the SCSI bus from glitching when user turns on or off the power of the CDU-720 or CDU-722. This feature can be very useful when the CDU-720/722 is used in the multiple host (initiator) configuration. User can turns off the power of one SCSI host, while the other host is accessing the shared SCSI devices. To enable the protection circuit of the single-ended SCSI port, jumper shunts need to be installed in W21 and W22 pin 2-3. To enable the protection circuit of the differential SCSI port, jumper shunts need to be installed in W21 and W22 pin 1-2.

3.2.9 DMA Burst Length and Dwell Time

The Busrt Length determines how many words the CDU-720 transfers by DMA during each NPR. The Dwell time is the time the CDU-720 waits before it requests for another NPR.

W9	W8	
2-3 IN	2-3 IN	1 word per NPR
2-3 IN	1-2 IN	2 words per NPR
1-2 IN	1-2 IN	4 words per NPR

W7		
	1-2 IN	4 micro second dwell time
	2-3 IN	2 micro second dwell time

Factory Settings:
CDU-720/T, CDU-720/TM 1 word per NPR, 2 micro second dwell time.
CDU-720/M, 4 words per NPR, 4 micro second dwell time.

IMPORTANT: If the CDU-720 is installed in a VAX BI Unibus (VAX 8350, 8750, etc) the setting must be 1 word per NPR and 2 micro second dwell time. Data compare errors will occur on the VAX BI Unibus if the throughput is set to more than the BI Unibus adapter can handle. On the PDP-11 and Non-BI VAX (VAX-730, 750, 780, and others) Unibus the user may set the controller to 4 words per NPR and 4 micro second Dwell time.

Figure 1 Jumper block location diagram of hardware rev. A

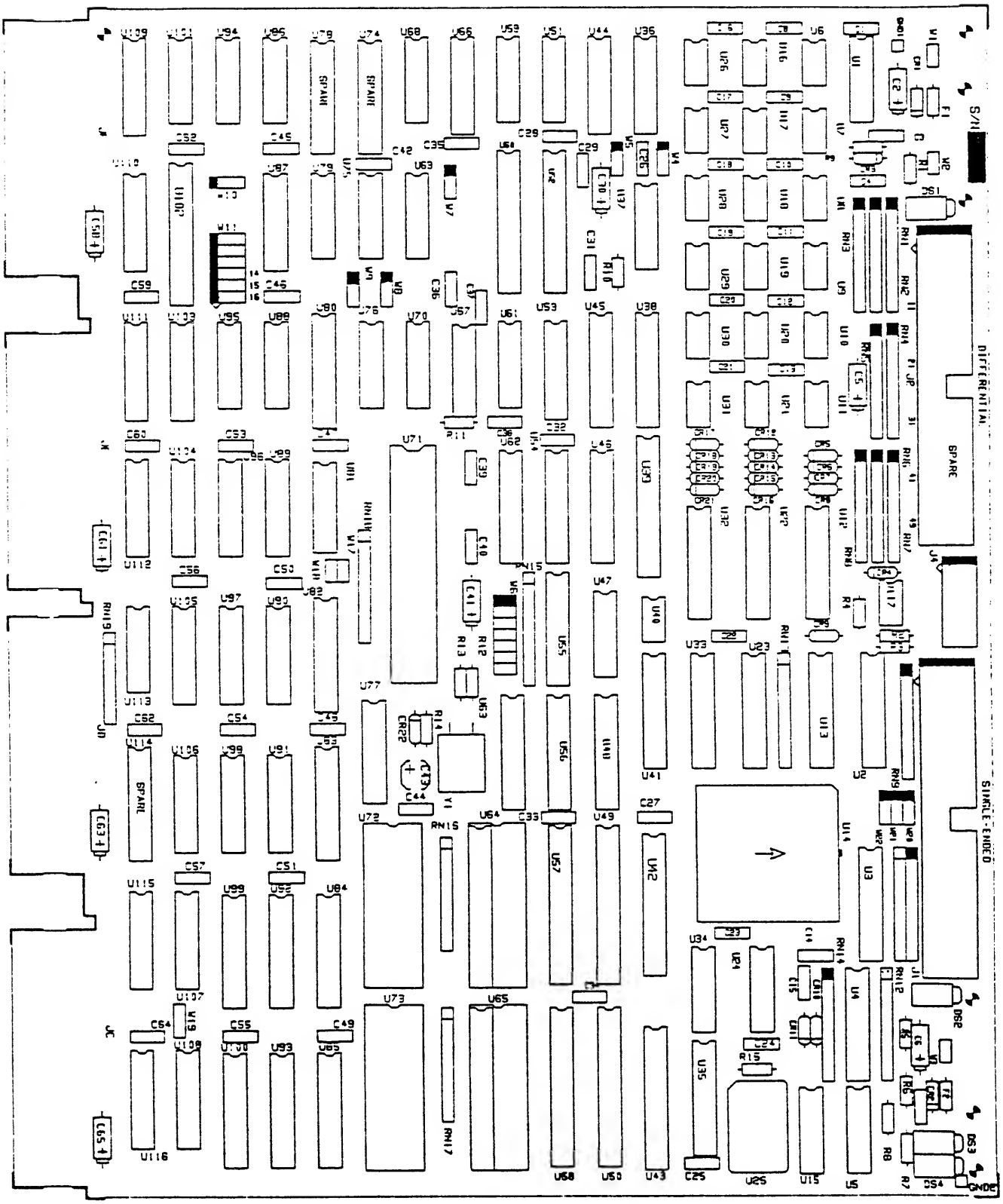


Table 1 Jumper Setting on the CDU-720

W1		Reserved (F)		
W2	OUT	Differential SCSI terminator power disabled(F)		
W2	IN	Differential SCSI terminator power enabled		
W3	OUT	Single-ended SCSI terminator power disabled(F)		
W3	IN	Single-ended SCSI terminator power enabled		
W4	1-2 IN	Reserved (F)		
FOR CDU-720/M, CDU-720/TM				
W5	2-3 IN	Auto-Boot Enabled		
	1-2 IN	Auto-Boot Disabled (F)		
W10	2-3 IN	Bootstrap address = 771000 (F)		
	1-2 IN	Bootstrap address = 773000		
FOR CDU-720/T				
W5	1-2 IN	Reserved (F)		
W6-1	W6-2	W6-3	Initiator ID	
IN	IN	IN	7	CDU-720 (F)
IN	IN	OUT	6	
IN	OUT	IN	5	
IN	OUT	OUT	4	
OUT	IN	IN	3	
OUT	IN	OUT	2	
OUT	OUT	IN	1	
OUT	OUT	OUT	0	lowest priority
W6-4	OUT	Normal operation (F)		
	IN	Tape Fast Search enabled		
W6-5,6,7	OUT	Reserved (F)		
W7	1-2 IN	4 uS dwell time between DMA		(F Disk only)
	2-3 IN	2 uS dwell time between DMA		(F Tape, /TM)
W9	W8			
2-3 IN	2-3 IN	1 word per DMA burst		(F Tape, /TM)
2-3 IN	1-2 IN	2 words per DMA burst		
1-2 IN	1-2 IN	4 words per DMA burst		(F Disk only)

CDU-720/M Disk only with the IC P72009A in U102:

Address	PDP-11	W11	W12	W13	W14	W15	
1	772150	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN	(F)
2	760334	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN	
3	760354	1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN	
4	760374	1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN	
5	760340	2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN	
6	760344	2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN	
7	760350	2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN	
8	760360	2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN	

Note: Refer to Appendix 4 for other CSR for Disk.

W16 1-2 IN don't care

CDU-720/T Tape Only with the IC P72010A in U102:

Address	PDP-11	W12	W13	W14	W15	W16	
1	774500	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN	(F)
2	760404	1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN	
3	760444	1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN	
4	760504	1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN	
5	760544	1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN	
6	760410	1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN	
7	760450	1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN	
8	760454	1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN	

Note: Refer to Appendix 5 for other CSR for Tape.

W11 1-2 IN don't care

CDU-720/TM Tape and Disk with the IC P72008A in U102:

Address	PDP-11	W11	W12	W13	
1	772150	1-2 IN	1-2 IN	1-2 IN	(F)
2	760334	1-2 IN	1-2 IN	2-3 IN	
3	760354	1-2 IN	2-3 IN	1-2 IN	
4	760374	1-2 IN	2-3 IN	2-3 IN	
5	760340	2-3 IN	1-2 IN	1-2 IN	
6	760344	2-3 IN	1-2 IN	2-3 IN	
7	760350	2-3 IN	2-3 IN	1-2 IN	
8	disable disk	2-3 IN	2-3 IN	2-3 IN	

Address	PDP-11	W14	W15	W16	
1	774500	1-2 IN	1-2 IN	1-2 IN	(F)
2	760404	1-2 IN	1-2 IN	2-3 IN	
3	760444	1-2 IN	2-3 IN	1-2 IN	
4	760504	1-2 IN	2-3 IN	2-3 IN	
5	760544	2-3 IN	1-2 IN	1-2 IN	
6	760410	2-3 IN	1-2 IN	2-3 IN	
7	760450	2-3 IN	2-3 IN	1-2 IN	
8	disable tape	2-3 IN	2-3 IN	2-3 IN	

W17,W18,W19		Reserved (F)
W20	1-2 IN	Enable Differential SCSI multiple host
W21	1-2 IN	protection circuit.
W22	1-2 IN	Differential SCSI mode selected
W20	2-3 IN	Enable Single-ended SCSI multiple host
W21	2-3 IN	protection circuit (F).
W22	2-3 IN	Single-ended SCSI mode selected (F)

Note: (F) means factory setting.
Note: J4 connector is used for in house diagnostic only.

3.3 CDU-720 Mounting Slot Selection

The CDU-720 can be installed in any priority on the standard PDP-11 Unibus SPC backplane. The CDU-720 is a DMA device and requires the Nonprocessor Grant (NPG) jumper on the SPC card slot in which the controller is being installed be removed. It is recommended that the CDU-720 be placed in front of other devices on the Unibus except when there is an Ethernet controller which should go first.

The CDU-720 should be inserted into C, D, E, F sockets of a Unibus slot.

3.3.1 NPG Non-Processor Grant Signal

The NPG signal jumper is located at pins CA1 to CB1 on the Unibus backplane. Figure 2 is a DD11-DK nine-slot backplane seen from the rear.

To locate the NPG jumper do the following:

From the rear of the backplane locate the card slot in which the board is to be installed. Note: Each card slot is 4 pins wide.

Locate the C socket and then locate the pins CA1 and CB1. Remove the jumper wire between the two pins.

Figure 2. WIRE WRAP SIDE OF BACKPLANE

3.4 LED Indicators

The CDU-720 has three LED's in the front of the board. The LED's are labeled DS2, DS3 and DS4.

LED	COLOR	INDICATIONS
DS2	Green	Single-ended SCSI mode selected.
DS3	Red	Error condition occured.
DS4	Green	Power up OK and activity indicator. On power up, this LED is turned on when the CDU-720 suceeds in the self-diagnostic testing. The LED blinks to show controller activity.

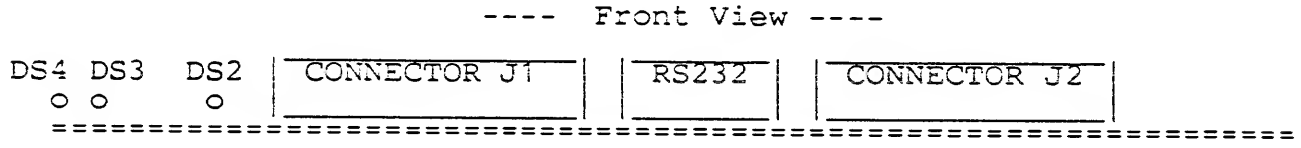


Figure 3 Front LED Assignment for CDU-720 Rev. A

The CDU-722 has four LED's in the front of the board. The LED's are labeled DS1, DS2, DS3 and DS4.

LED	COLOR	INDICATIONS
DS1	Green	Differential SCSI mode selected.
DS2	Green	Single-ended SCSI mode selected.
DS3	Red	Error condition occured.
DS4	Green	Power up OK and activity indicator. On power up, this LED is turned on when the CDU-722 succeeds in the self-diagnostic testing. The LED blinks to show controller activity.

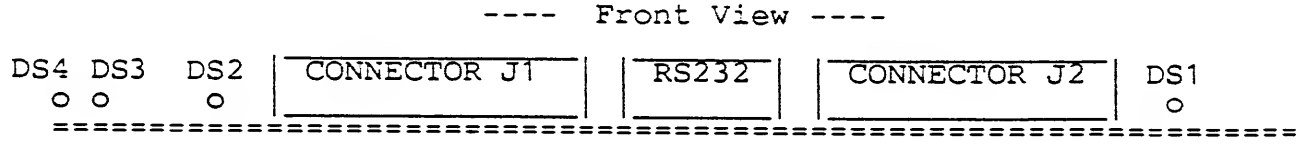


Figure 4 Front LED Assignment for CDU-722 Rev. A

3.5 SCSI Bus Cabling and Termination

3.5.1 Single-Ended

The CDU-720 provides a 50-pin connector (J1), to interface with external single-ended SCSI devices.

When the CDU-720 and the external SCSI drives are installed in the same cabinet which meets EMI/RFI shielding requirements, a 50-conductor flat cable or 25-signal twisted-pair cable can be used for connecting the CDU-720 (J1) and the external SCSI drives When the CDU-720 and the external SCSI drives are installed in seperated cabinets, the shielded SCSI cable should be used to meet FCC requirements.

Note that a minimum conductor size of 28 AWG shall be employed to minimize noise effects and ensure proper distribution of optional terminator power. The maximum cable length is 6.0 meters or 20 feet in single ended mode.

The SCSI bus signals should be terminated with 220 ohms to +5 volts and 330 ohms to ground at each end of the cable. The CDU-720 provides on-board removable terminators (RN9,RN10,RN14), which are next to the connector J1. Therefore, the CDU-720 can be installed in any position of the SCSI cable. If the CDU-720 is installed at either end of the SCSI cable, the on-board SCSI bus terminators should remain on the board. Otherwise, the on-board SCSI bus terminators should be removed.

3.5.2 Differential

The CDU-722 provides an additional 50-pin connector (J2), to interface with external differential SCSI devices.

When the CDU-722 and the external SCSI drives are installed in the same cabinet which meets EMI/RFI shielding requirements, a 50-conductor flat cable or 25-signal twisted-pair cable can be used for connecting the CDU-722 (J2) and the external SCSI drives When the CDU-722 and the external SCSI drives are installed in seperated cabinets, the shielded SCSI cable should be used to meet FCC requirements.

Note that the twisted pair cable is strongly recommended. Without twisted pairs, even at slow data transfer rates and very short distances, crosstalk between adjacent signals causes spurious pulses with differential signals. Cables should consist of conductors of 26AWG or 28AWG. The two wires of a pair should be connected to the same signal, one to the positive and the other to the negative signal. The maximum cable length is 25 meters or 82 feet in differential mode.

Every differential SCSI bus signal pair should be terminated with 330 ohms connected between the negative signal and +5 volts , 330 ohms connected between the positive signal and ground, and 150 ohms connected between the positive and the negative signal at each end of the SCSI cable. The CDU-722 provides on-board removable terminators (RN1,RN2,RN3,RN4,RN5,RN6,RN7,RN8) which are next to the connector J2. Therefore, the CDU-722 can be installed in any position of the SCSI cable. If the CDU-722 is installed at either end of SCSI cable, the on-board SCSI bus terminators should remain on the board. Otherwise, the on-board SCSI bus terminators should be removed.

3.6 SCSI Target ID Selection

Each SCSI device (Initiator or Target) on the SCSI bus requires a unique SCSI ID. Since the CDU-720 SCSI host adapter is factory configured to SCSI ID 7, the SCSI ID of the target devices (disk or tape) connected to the CDU-720 should be set from SCSI ID 0 to 6. Normally, the assignment of SCSI Target ID starts with ID 0. The CDU-720/M supports up to 7 disk drives. The disk drives' SCSI ID should be set from 0 to 6. The CDU-720/T supports up to 7 tape drives. The tape drives' SCSI ID should be set from 0 to 6. The CDU-720/TM supports up to 7 disk/tape drives combined totally. The disk and tape drives' SCSI ID can be set from 0 to 6 without overlapping. The factory default is 4 disk drives (ID=0 to 3) and 3 tape drives (ID=4 to 6).

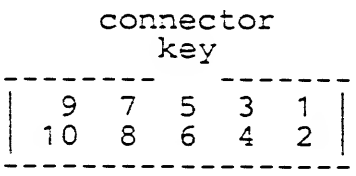
One example is provided to show the default mapping of SCSI ID to the VMS system. Assuming the first disk CSR and tape CSR addresses are used and the disk and tape LUN offsets are 0.

CDU-720/M	SCSI ID	VMS device	
	0	DUA0	;SCSI ID = Disk LUN
	1	DUA1	;Offset
	2	DUA2	
	3	DUA3	
	4	DUA4	
	5	DUA5	
	6	DUA6	
	7	PUA0 (CDU-720/M)	
CDU-720/T	SCSI ID	VMS device	
	0	MUA0	;SCSI ID = Tape LUN
	1	MUA1	;Offset
	2	MUA2	
	3	MUA3	
	4	MUA4	
	5	MUA5	
	6	MUA6	
	7	PTA0 (CDU-720/T)	
CDU-720/TM	SCSI ID	VMS device	
	0	DUA0	;SCSI ID = Disk LUN
	1	DUA1	;Offset
	2	DUA2	
	3	DUA3	
	4	MUA0	;(SCSI ID -4) = Tape
	5	MUA1	;LUN Offset
	6	MUA2	
	7	PUA0 and PTA0 (CDU-720/TM)	

3.7 RS-232 Utility Interface

The CDU-720 SCSI host adapter provides users with a 10 pin connector (J4) for on-board RS-232 utility or system front panel interface. To enable the front panel interface signals, user needs to install 6 jumper shunts, W4-1 to W4-5 and W5. No shunts are installed by factory in these locations. Note that don't install W5 jumper shunt unless there is a front panel circuit connected to J4. The physical pin number assignment and functions are described in the following. Please consult CMD Technology on the circuit necessary to implement the front panel interface.

Connector J4 pin definition when facing the 10 pin connector from the controller's top edge:



pin 1: Drive 1 on line, input/output signal, normally high.
pin 2: ground.
pin 3: TXD, for RS-232 application, transmit data.
pin 4: ground.
pin 5: Drive 0 activity, output signal, normally low.
pin 6: Drive 1 activity, output signal, normally low.
pin 7: Drive 1 write protect, input signal, active low.
pin 8: Drive 0 write protect, input signal, active low
or for RS-232 application, receive data.
pin 9: ground.
pin 10: Drive 0 on line, input/output signal, normally high.

Note that only pin 3 , 8 and grounds are used by the CMD on-board RS-232 utility.

3.8 Special Features

The CMD CDU-720 controller provides the following special features for the users, such as multi-hosting, partitioning, shadowing, tape monitor utility, on-line formatting, SCSI library Manager and generic SCSI adapter, etc. Call CMD's technical support hotline for additional information.

Table 2 CDU-720 Special Feature Support List

Model	Multi-Host	Partition	Shadow	TMU	FMT	SLM	GSA
/TM	Yes	Yes	No	Yes	Yes	No	No
/TMS	Yes	Yes	Yes	Yes	Yes	No	No
/TMJ	Yes	Yes	No	Yes	Yes	Yes	No
/TMP	Yes	Yes	No	Yes	No	No	Yes

3.8.1 Multi-Hosting

CDU-720 gives users the ability to completely share an array of disks and tapes between multiple DEC systems running Local Area Cluster (LAVC) software. CMD's multi-host solution has every feature found in DSSI, with the additional capability to support tape and optical devices including jukeboxes. The following integration notes are provided to insure a faster and more efficient installation.

Integration Notes:

1. Change to CMD's on-board utility: a. Disable SCSI reset on each CMD host adapter so that power up or power down the system will not interfere another running system. b. The CMD host adapter that you configure as ID#7 should not address the other CMD host adapters as target devices.
2. Use SCSI pass-thru type SCSI connector at junction to VAX back panel.
3. Use right angle Centronics SCSI connector/cable at junction to VAX on all Micro VAX III's, VAX 4000's.
4. Use external terminators at each end of the SCSI bus.
5. Remove all the on-board SCSI terminators and enable the SCSI terminator power jumpers for the SCSI channels which are on the end of the SCSI bus.
6. Limit total cable lengths (including internal subsystem loop cables) to 20 feet for single-ended applications (80 feet for differential applications).

7. CMD's multi-host feature has been tested out on the following disk and tape devices. (Call for specific peripherals not on this list):

Seagate disks (Elite, Wren V, Wren VI, Wren VII)
Hitachi disks (DK515C)
Fujitsu disks (M2263SA)
Micropolis disks (1588-15)
Sony erasable optical disks (Version 2.07 and up)
Exabyte 8mm tapes (8200)
4mm DAT tapes (all those supporting SCSI reserve and release commands)

The following diagram gives an overview on how to connect CMD Q-bus and Unibus SCSI host adapters and third party disk and tape arrays for true multi-hosting. CMD provides the cables and terminators shown below as a service to our users. Call CMD's technical support hotline for more detailed information.

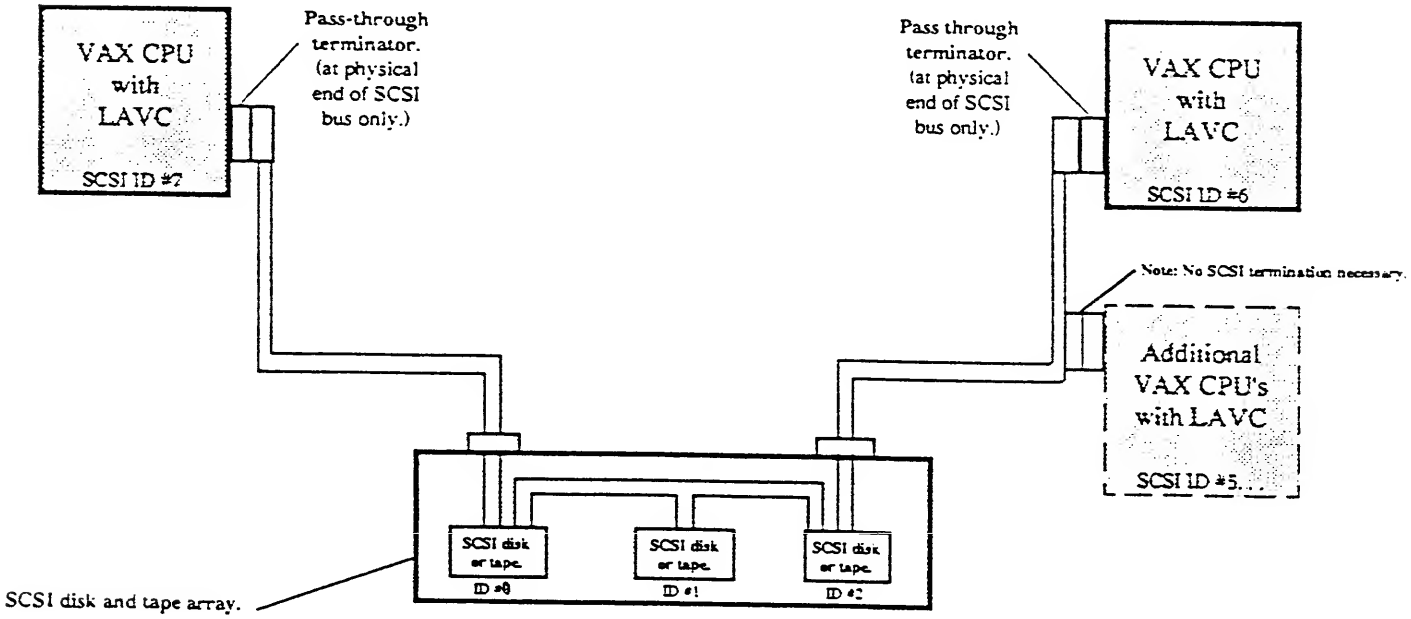


Figure 5 Multi-Hosting Connection Example Diagram

3.8.2 Partitioning

The Partition is an added feature for CDU-720/TM. User can set-up the partition of the disk drives through the CMD on-board utilities. Any disk drive can be partitioned into two or four equally divided partitions.

Please refer to section 4.3 RS232 Utilities for more details.

3.8.3 Shadowing

The Super Shadow CDU-720/TMS is a hardware variation of the CDU-720/TM.

Installation and set-up of CMD shadowing host adapters are simplifed with the CMD on-board utilities. This easy to use menu-driven utility allows users to quickly configure virtually any combination of disk shadow sets.

The hardware disk shadowing on DEC computers enables simultaneous writing of data to two shadow set members. This provides an exact real-time duplicate data set that can be later retrieved by the user if data on primary disk becomes unaccessable.

The access performance benefits are derived from the ability to read data from a particular disk in the shadow set that reponds faster. By adapting specific host adapter resident firmware algorithms, CDU-720/TMS provides incredible performance benefits with disk access time reduced 100% or more.

The hardware-based shadowing technique also results in far less VMS overhead and much higher data availablity than software solutions.

DEC users can now configure complete fault tolerant SCSI subsystems built around Super Shadow host adapters. When used in conjunction with other CMD exclusive features like Multi-Host capability, you can now achieve true "no single point of failure" in your SCSI disk arrays.

3.8.4 Tape Monitor Utility

The Tape Monitor Utility (TMU) is an application software developed by CMD Technology and works exclusively with CMD SCSI host adapters as an optional feature for VAX/VMS systems.

This Tape Monitor Utility runs under VMS and displays the tape drive vender identification, drive firmware revision, the remaining tape capacity, percentage of rewrite and ECC retry, and current tape operations such as read, write, write file mark, space, rewind etc. Users can install multiple tape subsystems in one site and observe the tape activity from any VAX terminal locally or across the network without any additional add-in hardware. Users can also open a file to log all the information for unattended backup.

Before installing the Tape Monitor Utility application software, a jumper shunt should be inserted in W10-7 location. For any operating system other than VMS, this jumper should not be installed. Do not insert this jumper shunt either if the TMU application software is not installed. The factory setting of W10-7 is in OUT position (TMU disabled).

W10-7	IN	TMU enabled
	OUT	TMU disabled (factory)

3.8.5 SCSIformat ON-LINE

The SCSIformat ON-LINE (FMT) is an application software developed by CMD Technology and works exclusively with CMD SCSI host adapters as an optional feature for VAX/VMS systems.

This SCSIformat ON-LINE runs under VMS and allows the user to format the disk drives without interferring with the other tasks on going.

Before installing the SCSIformat ON-LINE application software, a jumper shunt should be inserted in W10-7 location. For any operating system other than VMS, this jumper should not be installed. Do not insert this jumper shunt either if the application software is not installed. The factory setting of W10-7 is in OUT position (FMT disabled).

W10-7	IN	FMT enabled
	OUT	FMT disabled (factory)

Note: 1. W10-7 is also an enable/disable jumper for TMU.
2. /TMP do not have the SCSIformat ON-LINE option.

3.8.6 SCSI Library Manager

The SCSI Library Manager (SLM) is an application software developed by CMD Technology and works exclusively with CMD SCSI host adapter CDU-720/TMJ for VAX/VMS systems.

This SCSI Library Manager runs under VMS and was designed to work with multiple jukeboxes as well as a single jukebox with from one to five erasable optical or WORM drives installed. Just a few menu-driven keystrokes SLM controls all basic operations like inserting, removing and flipping erasable or WORM cartridges from the drive unit.

In addition to giving the user complete control of jukebox functions, SLM also has a build-in callable user interface allowing users to customize SLM to their needs. This is especially useful for applications to support file management.

3.8.7 Generic SCSI Adapter

The Generic SCSI Adapter (GSA) is an application software developed by CMD Technology and works exclusively with CMD SCSI host adapter CDU-720/TMP for VAX/VMS systems.

This Generic SCSI Adapter runs under VMS and allows the user to send the generic SCSI commands to the disk or tape drives through the standard DEC DU driver.

The GSA itself is a simple and straightforward callable user interface providing an easier way for user to communicate with the device directly.

Note: The CDU-720/TMP do not support the jukebox operation.

CHAPTER 4 ON-BOARD UTILITY

4.1 Disk Utility for the CDU-720/M, CDU-720/TM

The CMD Technology Utility Program provides a convenient means of formatting and configuring the drive and configuring the logical unit number offset. The utility program can be started by means of an ODT command. For Example:

PDP-11/24 SYSTEMS

1. Hit the Boot Switch.
2. Halt the processor.
3. 17772152/004400 123456 <CR> ;DEPOSIT 123456 TO ; CSR BASE ADDRESS + 2
4. 17772152/001000 100 <CR> ;DEPOSIT 100 TO ; CSR BASE ADDRESS + 2
5. 5000G ;5000 and a G ;The Utility program ;will begin executing.

Note that the address shown in step 3 is equal to the address selected by CSR jumpers plus 2.

PDP-11/34 SYSTEMS

1. Enter ODT mode
2. From the terminal type ; DEPOSIT 123456 TO
   L 772152 <CR> ; CSR BASE ADDRESS + 2
   D 123456 <CR>
3. L 772152 <CR> ; DEPOSIT 100 TO
   D 100 <CR> ; CSR BASE ADDRESS + 2
4. L 5000 <CR> ; 5000 and a S
   S <CR> ; The Utility program ; will begin executing.

The utility will display:

```
SCSI UTILITY PROGRAM

     DISK            TAPE
1 = 772150      A = 774500
2 = 760334      B = 760404
3 = 760354      C = 760444
4 = 760374      D = 760504
5 = 760340      E = 760544
6 = 760344      F = 760410
7 = 760350      G = 760450
8 = 760360      H = 760454

SELECT CSR ADDRESS
```

The user will then select the number which matches with the address selected by the CSR jumpers. The main menu will display

```
1 = BOOT DRIVE
2 = CONFIGURE LUN OFFSET
3 = FORMAT DRIVE
4 = QUALIFY DRIVE
5 = MANUAL REPLACE BAD SECTORS
6 = READ, WRITE AND VERIFY TEST
7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :
```

The operator now has 7 options to choose from. To specify or to check the configuration of a drive, the operator types in a 2. If at any time the operator types in a ctrl C, the command is aborted and the utility program returns to the main menu. If the operator types in <CR> with no value, then the parameters will remain unchange.

4.1.1 Configure LUN Offset

LUN Offset: For PDP-11 systems, each MSCP drive requires a different Logical Unit Number. If there are no other MSCP controllers in the system, then the LUN offset number is 0 (Drive 0 will be LUN 0, and Drive 1 will be LUN 1). If there exists another MSCP controller with 4 LUN units (0 to 3), then the LUN offset should be 4. In this case Drive 0 will be LUN 4 and Drive 1 will be LUN 5. Normally, when the CDU-720 is used in VMS operating system, the LUN Offset should remain as factory setting (LUN=0).

```
      1 = BOOT DRIVE
      2 = CONFIGURE LUN OFFSET
      3 = FORMAT DRIVE
      4 = QUALIFY DRIVE
      5 = MANUAL REPLACE BAD SECTORS
      6 = READ, WRITE AND VERIFY TEST
      7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :  2

PRESENT LUN OFFSET = 0, ENTER NEW VALUE:
SAVE NEW CONFIGURATION (Y or N)?   Y
COMPLETE.
```

4.1.2 Format Drive

Formatting a drive will rewrite all the sectors on the drive. In this option, the CDU-720 issues Format Unit Command to the selected SCSI disk drive and requests it to map out the defects on the Manufacture Defect List (MDL). It is recommended to use qualify drive option after formatting the disk drive.

```
      1 = BOOT DRIVE
      2 = CONFIGURE LUN OFFSET
      3 = FORMAT  DRIVE
      4 = QUALIFY DRIVE
      5 = MANUAL REPLACE BAD SECTORS
      6 = READ, WRITE AND VERIFY TEST
      7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :  3

ENTER DRIVE NUMBER <0 TO 6> :  0

*** WILL DESTROY DATA ON DRIVE 0, ARE YOU SURE?  Y

WAIT.....

COMPLETE.
```

4.1.3 Qualify Drive

The qualify program will write different patterns into the drive and then verify the pattern. If there is any bad sector, the sector will be automatically replaced.

To ensure a defect free drive, the qualify program should be run at least 10 passes.

```
     1 = BOOT DRIVE
     2 = CONFIGURE LUN OFFSET
     3 = FORMAT DRIVE
     4 = QUALIFY DRIVE
     5 = MANUAL REPLACE BAD SECTORS
     6 = READ, WRITE AND VERIFY TEST
     7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :  4

QUALIFY DRIVE # <0 TO 6>:  0
*** WILL DESTROY DATA ON THIS DRIVE, ARE YOU SURE?  Y

QUALIFY LOOP 1

TO ABORT, ENTER ^C ( CONTROL C).
```

4.1.4 Manual Replace Bad Sectors

This program allows user to replace bad sectors found in the future.

```
     1 = BOOT DRIVE
     2 = CONFIGURE LUN OFFSET
     3 = FORMAT DRIVE
     4 = QUALIFY DRIVE
     5 = MANUAL REPLACE BAD SECTORS
     6 = READ, WRITE AND VERIFY TEST
     7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :  5

ENTER DRIVE NUMBER <0 TO 6>:  0

REPLACE LOGICAL BLOCK NUMBER ?  XXXXXX

REPLACE LOGICAL BLOCK XXXXXX. ARE YOU SURE ?  Y

--REPLACED--
```

4.1.5 Read, Write and Verify Test

This option allows user to test the integrity of the controller board, drive cable and disk drive. The program will generate random data patterns for testing.

```
      1 = BOOT DRIVE
      2 = CONFIGURE LUN OFFSET
      3 = FORMAT DRIVE
      4 = QUALIFY DRIVE
      5 = MANUAL REPLACE BAD SECTORS
      6 = READ, WRITE AND VERIFY TEST
      7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :  6

RANDOM READ WRITE TEST
DO YOU WANT READ ONLY ? <Y OR N>  N

DRIVE NUMBER <0 TO 6>:  0
*** WILL DESTROY DATA ON THIS DRIVE, ARE YOU SURE?  Y

TEST FROM BLOCK # <0-XXXXX> ?

TO BLOCK # <XXXXX-YYYYY> ?

TESTING STARTED. TYPE CTRL-C TO ABORT.
```

4.1.6 Utility Bootstrap

To bootstrap the operating system on drive 0 to 6, just select option 1 from main menu.

```
      1 = BOOT DRIVE
      2 = CONFIGURE LUN OFFSET
      3 = FORMAT DRIVE
      4 = QUALIFY DRIVE
      5 = MANUAL REPLACE BAD SECTORS
      6 = READ, WRITE AND VERIFY TEST
      7 = ADDITIONAL SCSI COMMANDS

SELECT OPTION :  1

BOOT DRIVE NUMBER <0 TO 6>   0

BOOT DU0. ARE YOU SURE ?   Y

WAIT ...
```

4.1.7 Additional Utilities

User can use this option to display the SCSI ID's of the attached SCSI devices, issue SCSI commands to the selected device, test SCSI devices and format the disk drive RCT (replacement and caching table) blocks. When this option is selected, the menu will display

```
ADDITIONAL UTILITIES  (REV. XX)          SN = XXXX

     D = SETUP CONFIGURATION AND DISPLAY SCSI DEVICE
     S = SEND SCSI COMMAND TO THE DEVICE
     T = TEST SCSI DEVICE
     R = FORMAT RCT BLOCK

SELECT OPTION ?
```

Note: 1. Partitioning and Shadowing configuration are set-up through the 'D' selection.
2. Please refer to section 4.3 for details.

4.2 Tape Utility for the CDU-720/T, CDU-720/TM

The utility program can be started by means of an ODT command.

For Example:

PDP-11/24 SYSTEMS

1. Hit the Boot Switch.
2. Halt the processor.
3. 17774502/004700 123456 <CR> ;DEPOSIT 123456 TO
   ; CSR BASE ADDRESS + 2
4. 17774502/001000 100 <CR> ;DEPOSIT 100 TO
   ; CSR BASE ADDRESS + 2
5. 5000G ;5000 and a G
   ;The Utility program
   ;will begin executing.

Note that the address shown in step 3 is equal to the address selected by ccsr jumpers.

PDP-11/34 SYSTEMS

1. Enter ODT mode
2. From the terminal type ; DEPOSIT 123456 TO
   L 774502 <CR> ; CSR BASE ADDRESS + 2
   D 123456 <CR>
3. L 774502 <CR> ; DEPOSIT 100 TO
   D 100 <CR> ; CSR BASE ADDRESS + 2
4. L 5000 <CR> ; 5000 and a S
   S <CR> ; The Utility program
   ; will begin executing.

The utility will display:

```
SCSI UTILITY PROGRAM

     DISK            TAPE
1 = 772150      A = 774500
2 = 760334      B = 760404
3 = 760354      C = 760444
4 = 760374      D = 760504
5 = 760340      E = 760544
6 = 760344      F = 760410
7 = 760350      G = 760450
8 = 760360      H = 760454

SELECT CSR ADDRESS
```

The user will then select the number which matches with the tape CSR address selected by the csr jumpers.

The main menu will display

```
1 = BOOT DRIVE
2 = CONFIGURE LUN (Logical Unit Number) OFFSET
3 = TAPE DIAGNOSTIC

SELECT OPTION :
```

The operator now has 3 options to choose from. To specify or to check the configuration of a drive, the operator types in a 2. If at any time the operator types in a ctrl C, the command is aborted and the utility program returns to the main menu. If the operator types in <CR> with no value, then the parameters will remain unchange.

4.2.1 Configure LUN Offset

For the PDP-11 systems, each TMSCP drive requires a different Logical Unit Number. If there are no other TMSCP controllers in your system, then the LUN offset number is 0 (Drive 0 will be LUN 0, and Drive 1 will be LUN 1). If there exists another TMSCP controller with 4 LUN units (0 to 3), then the LUN offset should be 4. In this case Drive 0 will be LUN 4 and Drive 1 will be LUN 5. Normally, when the CDU-720 is used in VMS operating system, the LUN Offset should remain as factory setting (LUN=0).

```
MAIN MENU

     1 = BOOT DRIVE
     2 = CONFIGURE LUN (Logical Unit Number) OFFSET
     3 = TAPE DIAGNOSTIC

SELECT OPTION :  2

PRESENT LUN OFFSET = 0, ENTER NEW VALUE:  X
SAVE NEW CONFIGURATION (Y or N)?   Y
COMPLETE.
```

4.2.2 Boot Drive

To bootstrap the operating system on drive 0 to 6, just select option 1 from main menu.

```
     1 = BOOT DRIVE
     2 = CONFIGURE LUN (Logical Unit Number) OFFSET
     3 = TAPE DIAGNOSTIC

SELECT OPTION :  1

BOOT DRIVE NUMBER <0 TO 6>   0

BOOT MU0. ARE YOU SURE ?   Y

WAIT ...
```

4.2.3 Tape Diagnostic

User can use this option to test the integrity of the CDU-720, SCSI cable, and the tape drives connected.

4.2.4 Additional Utilities

User can use this option to display the SCSI ID's of the attached SCSI devices, issue SCSI commands to the selected device, and test SCSI devices. When this option is selected, the menu will display

```
ADDITIONAL UTILITIES  (REV. XX)          SN = XXXX

     D = SETUP CONFIGURATION AND DISPLAY SCSI DEVICE
     S = SEND SCSI COMMAND TO THE DEVICE
     T = TEST SCSI DEVICE

SELECT OPTION ?
```

Note: Please refer to section 4.3 for details.

4.3 RS-232 Utility for CDU-720/M/T/TM

This is a general purpose on-board utility for any DEC system with Q-bus. To access the RS-232 utility, user needs to connect a terminal and cable to the CDU-720's RS-232 port (10 pin connector J4 of CDU-720),and sets the terminal baud rate to 9600 (8 bit data, no parity). Then halt the system, toggle the reset switch and hit carriage return <CR>. The main menu will be displayed automatically on the terminal.

Once the main utility menu shows up, user can key in the number or letter and <CR> to select the desired option. Press the <BREAK> or <CONTROL C> at any time to reset the SCSI bus and return to the main menu.

Please note that the pin 8 (receive data) of the CDU-720's RS-232 port is also used as a write protect input for the front panel interface of the controller during normal operation. Remove the terminal cable from the RS-232 port after using the SCSI utility.

For the CDU-720/M, the main menu of the utility will display:

```
SCSI HOST ADAPTER UTILITY   (REV. XX)

1 = LOGICAL UNIT NUMBER OFFSET
2 = FORMAT DRIVE
3 = QUALIFY DRIVE
4 = MANUALLY REPLACE BAD BLOCKS
5 = ADDITONAL UTILITIES

SELECT OPTION ?
```

For the CDU-720/T, the main menu of the utility will display:

```
SCSI HOST ADAPTER UTILITY   (REV. XX)

1 = LOGICAL UNIT NUMBER OFFSET
2 = ADDITIONAL UTILITIES

SELECT OPTION ?
```

For the CDU-720/TM, the main menu of the utility will display:

```
SCSI HOST ADAPTER UTILITY   (REV. XX)

[DISK]                                  [TAPE]
1 = LOGICAL UNIT NUMBER OFFSET          6 = LOGICAL UNIT NUMBER OFFSET
2 = FORMAT DRIVE                        7 = ADDITIONAL UTILITIES
3 = QUALIFY DRIVE
4 = MANUALLY REPLACE BAD BLOCKS
5 = ADDITONAL UTILITIES

SELECT OPTION ?
```

The sub-menu for the additional utilities will display:

```
ADDITIONAL UTILITIES   (REV. XX)              SN = XXXX

D = SETUP CONFIGURATION AND DISPLAY SCSI DEVICE
S = SEND SCSI COMMAND TO THE DEVICE
T = TEST SCSI DEVICE
R = FORMAT RCT BLOCK

SELECT OPTION ?
```

Selection 'D' can be used to change the controller default configurations, such as number of disk and tape devices supported, SCSI ID and SCSI LUN assignment, disk partition selection, disk shadow set selection (for /TMS only), SCSI reset enable/disable, SCSI disconnect enable/disable, sync/async mode selection, tape buffer mode enable/disable, prevent medium removal enable/disable, disk write with verify enable/disable, etc. It will also scan/display the SCSI devices attached to the controller.

Selection 'S' can be used to send generic SCSI commands to the selected disk/tape drives directly.

Selection 'T' can be used to either read or write/read/verify the selected disk/tape drive continuously.

Selection 'R' can be used to format the RCT blocks of the disk drive selected.

Note: The disk drive can only be partitioned into two or four equally divided partition. After the drive been partitioned, selection 'R' should be used to format the RCT blocks of each partition properly.

4.4 ODT Utility

When the CDU-720/M is used in VAX-11/730, 750 , 780 systems, the ODT utility is required to format or qualify a disk drive.

The effective addresses ([EA]) of IP and SA registers of CDU-720/M for VAX-11/730 and VAX-11/750 are listed in the following table.

OCTAL ADDRESS	HEX ADDRESS
772150	FFF468
772152	FFF46A
760334	FFE0DC
760336	FFE0DE
760354	FFE0EC
760356	FFE0EE
760374	FFE0FC
760376	FFE0FE
760340	FFE0E0
760342	FFE0E2
760344	FFE0E4
760346	FFE0E6
760350	FFE0E8
760352	FFE0EA
760360	FFE0F0
760362	FFE0F2

The effective addresses ([EA]) of IP and SA registers of CDU-720/M for VVAX-11/780 are listed in the following table.

OCTAL ADDRESS	HEX ADDRESS FOR UBA 1	HEX ADDRESS FOR UBA 2	HEX ADDRESS FOR UBA 3	HEX ADDRESS FOR UBA 4
772150	2013F468	2017F468	201BF468	201FF468
772152	2013F46A	2017F46A	201BF46A	201FF46A
760334	2013E0DC	2017E0DC	201BE0DC	201FE0DC
760336	2013E0DE	2017E0DE	201BE0DE	201FE0DE
760354	2013E0EC	2017E0EC	201BE0EC	201FE0EC
760356	2013E0EE	2017E0EE	201BE0EE	201FE0EE
760374	2013E0FC	2017E0FC	201BE0FC	201FE0FC
760376	2013E0FE	2017E0FE	201BE0FE	201FE0FE
760340	2013E0E0	2017E0E0	201BE0E0	201FE0E0
760342	2013E0E2	2017E0E2	201BE0E2	201FE0E2
760340	2013E0E4	2017E0E4	201BE0E4	201FE0E4
760342	2013E0E6	2017E0E6	201BE0E6	201FE0E6
760350	2013E0E8	2017E0E8	201BE0E8	201FE0E8
760352	2013E0EA	2017E0EA	201BE0EA	201FE0EA
760350	2013E0F0	2017E0F0	201BE0F0	201FE0F0
760352	2013E0F2	2017E0F2	201BE0F2	201FE0F2

Users can also follow the ODT utility procedure to communicate the CDU-720 SCSI host adapter with the system directly.

4.4.1 ODT Bootstrap

For LSI-11 only

```
17772150/000000  0              ;Enter 0 to CSR address
17772152/005400  123456         ;ODT utility, CSR+2
/001000  600                    ;BOO
/004000  0                      ;Logic unit number
R0/xxxxxx 0                     ;boot from LUN 0
R1/xxxxxx 172150                ;CSR address
R7/xxxxxx 0                     ;Start from 0
RS/xxxxxx 340                   ;Highest priority
P                               ;Proceed
```

4.4.2 Specify LUN Offset

a. LSI-11

```
17772150/000000  0              ;CSR address
17772152/005400  123456         ;CSR+2
/001000 42
/004000 0                       ;LUN offset
```

b. VAX

```
>>>D/W/P [EA]      0            ;CSR address
>>>D/W/P [EA]+2    A72E         ;CSR+2
>>>D * 22                       ;If * is not accepted, then
                                ;type D/W/P [EA]+2  22
>>>D * 0                        ;CSR+2 with LUN offset
```

4.4.3 Verify LUN Offset

a. LSI-11

```
17772150/000000  0              ;CSR address
17772152/005400  123456         ;CSR+2
/001000 43
/offset 0                       ;Display LUN offset
```

b. VAX

```
>>>D/W/P [EA]      0            ;CSR address
>>>D/W/P [EA]+2    A72E         ;CSR+2
>>>D * 23                       ;CSR+2
>>>E *                          ;CSR+2, Display LUN offset
```

4.4.4 Format Drive

a. LSI-11

```
17772150/000000  0              ;CSR address
17772152/005400  123456         ;CSR+2
/001000 40
/004000  0                      ;Select drive 0
/010000  0                      ;Drive volume serial number
/020000                         ;Value=20000, formatting
                                ;Value=0, format complete
```

b. VAX

```
>>>D/W/P [EA]      0            ;CSR address
>>>D/W/P [EA]+2    A72E         ;CSR+2
>>>D * 20                       ;CSR+2, if * is not accepted,
                                ;then type D/W/P [EA]+2   20
>>>D * 0                        ;CSR+2, Select drive 0
>>>D * 0                        ;Drive volume serial number
>>>E *                          ;Value=2000, formatting
```

```
                                        ;Value=0, format complete
```

4.4.5 Qualify Drive

a. LSI-11

```
17772150/000000  0              ;CSR address
17772152/005400  123456         ;CSR+2
/001000 41
/004000 0                       ;Select drive 0
/loop count                     ;Show current qualify loop
                                ;count
```

b. VAX

```
>>>D/W/P [EA]      0            ;CSR address
>>>D/W/P [EA]+2    A72E         ;CSR+2
>>>D * 21                       ;CSR+2 if * is not accepted,
                                ;then type D/W/P [EA]+2  21.
>>>D * 0                        ;CSR+2,Select drive 0
>>>E *                          ;Show current qualify loop
                                ;count at CSR+2
```

Note: [EA] is the CSR Effective Addresses listed in 4.4.
[EA]+2 is the CSR Effective Address plus 2.

CHAPTER 5 SCSI INFORMATION

5.1 SCSI Definitions:

Connect: The function that occurs when an initiator selects a target to start an operation.

Disconnect: The function that occurs when a target release control of the SCSI bus, allowing it to go to the BUS FREE phase.

Initiator: An SCSI device (usually a host system) that requests an operation to be performed by another SCSI device.

LUN: Logic Unit Number

Peripheral device: A peripheral that can be attatched to an SCSI device (e.g., magnetic disk, magnetic tape, or optical disk).

Reconnect: The function that occurs when a target selects an initiator to continue an operation after a disconnect.

SCSI address: The octal representation of the unique address (0-7) assigned to an SCSI device. This address would normally be assigned and set in the SCSI device during system installation.

SCSI ID: The bit-significant representation of the SCSI address refering to one of the signal lines DB(7-0).

SCSI device: A host computer adapter or a peripheral controller or an intelligent peripheral that can be attatched to the SCSI bus.

Target: An SCSI device that performs an operation requested by an initiator.

5.2 SCSI Commands

SCSI commands used by CDU-720/TM for MSCP emulation are listed in the following table.

Code	Command Name
00h	Test Unit Ready
01h	Rezero Unit
03h	Request Sense
04h	Format Unit (1)
07h	Reassign Block
08h	Read
0Ah	Write
0Bh	Seek
12h	Inquiry
15h	Mode Select
16h	Reserve Unit
17h	Release Unit
1Ah	Mode Sense
1Bh	Start/Stop Unit
1Eh	Prevent/Allow Medium Removal
25h	Read Capacity
28h	Extended Read
2Ah	Extended Write
2Bh	Extended Seek
3Eh	Read Long (2)
3Fh	Write Long(2)

(1) The Format Unit command is used by the on-board utility only.
(2) These commands are used if the drives support them.

SCSI commands used by CDU-720/TM for TMSCP emulation are listed in the following table.

Code	Command Name
00h	Test Unit Ready
01h	Rewind
03h	Request Sense
08h	Read
0Ah	Write
10h	Write Filemarks
11h	Space
12h	Inquiry
15h	Mode Select
16h	Reserve Unit
17h	Release Unit
19h	Erase
1Ah	Mode Sense
1Bh	Load/Unload
1Eh	Prevent/Allow Medium Removal

5.3 SCSI Status

The SCSI status codes used by CDU-720 are listed in the following table.

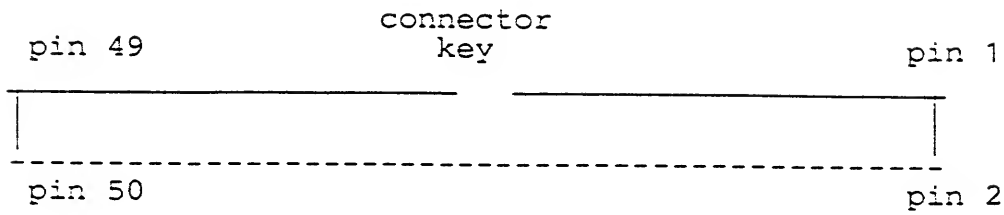
Code	Status Name
00h	Good
02h	Check Condition
08h	Busy
10h	Intermediate/Good
18h	Reservation Conflict

5.4 SCSI Messages

The SCSI Messages used by CDU-720 are listed in the following table.

Code	Message Name
00h	Command Complete
01h	Extended Message
02h	Save Data Pointer
03h	Restore Pointer
04h	Disconnect
05h	Initiator Detected Error
07h	Message Reject
08h	No Operation
09h	Message Parity Error
80-FFh	Identify

5.5 SCSI Single-Ended Signals

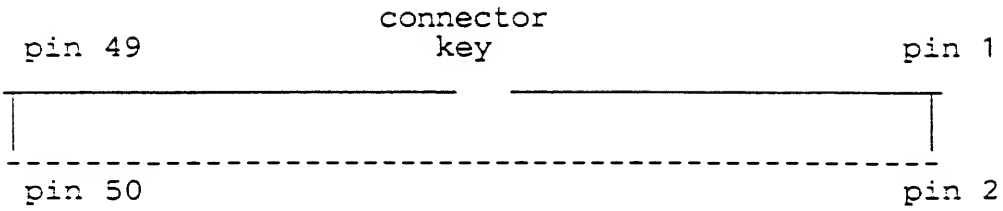


Signal	Pin Number
-DB(0)	2
-DB(1)	4
-DB(2)	6
-DB(3)	8
-DB(4)	10
-DB(5)	12
-DB(6)	14
-DB(7)	16
-DB(P)	18
GROUND	20
GROUND	22
GROUND	24
TERMPWR	26
GROUND	28
GROUND	30
-ATN	32
GROUND	34
-BSY	36
-ACK	38
-RST	40
-MSG	42
-SEL	44
-C/D	46
-REQ	48
-I/O	50

Table 3 CDU-720 Single-ended SCSI Connector (J1) Pin Assignment

NOTE: All odd pins except pin 25 are connected to ground. Pin 25 is left open. The minus sign next to the signal indicates active low.

5.6 SCSI Differential Signals



Signal	Pin Number		Signal
GROUND	1	2	GROUND
+DB(0)	3	4	-DB(0)
+DB(1)	5	6	-DB(1)
+DB(2)	7	8	-DB(2)
+DB(3)	9	10	-DB(3)
+DB(4)	11	12	-DB(4)
+DB(5)	13	14	-DB(5)
+DB(6)	15	16	-DB(6)
+DB(7)	17	18	-DB(7)
+DB(P)	19	20	-DB(P)
DIFFSENS	21	22	GROUND
GROUND	23	24	GROUND
TERMPWR	25	26	TERMPWR
GROUND	27	28	GROUND
+ATN	29	30	-ATN
GROUND	31	32	GROUND
+BSY	33	34	-BSY
+ACK	35	36	-ACK
+RST	37	38	-RST
+MSG	39	40	-MSG
+SEL	41	42	-SEL
+C/D	43	44	-C/D
+REQ	45	46	-REQ
+I/O	47	48	-I/O
GROUND	49	50	GROUND

Table 4 CDU-720 Differential SCSI Connector (J2) Pin Assignment

sible for returning the defective board to CMD within seven (7) days after receipt of the swapped board.

- The remaining warranty period shall apply to the repaired or swapped board.

Out-of-Warranty (more than 1 year)

- CMD offers a *15 working day turnaround repair service* at a rate of $300.00 plus parts and freight for all out-of-warranty host adapter boards. Defective boards will be repaired and returned to customer within 15 working days starting with date of return to CMD.
- CMD also offers an *out-of-warranty 24 Hour Turnaround Loaner Service:* Under this policy, CMD will ship the same model loaner in the 24 hour time frame of working days to customer for an additional charge of $100.00 plus freight per loaner. The loaner is for use by the customer during the period that the defective board is being repaired. Customer is responsible for returning the defective board to CMD within seven days after the receipt of loaner and returning the loaner in seven (7) days once the defective board is repaired and received. The approval of the loaner service is at CMD's option and based upon customer credit verification.
- CMD will extend warranty for a period of six (6) months on any out of- warranty repaired board.

Cable

In-Warranty (90 days) - free swap.
Out-of-Warranty (90 days) - not applicable.

Drive

In-Warranty (per manufacturer) - manufacturer charge only.
Out-of-Warranty (per manufacturer) - manufacturer charge plus $100 CMD handling.

RETURN FOR UPGRADE/UPDATE

CMD Host Adapter

In-Warranty (less than 1 year)

- CMD offers a *15 working day turnaround different function upgrade service* for boards that can be upgraded to a higher function; and a *free 15 working day turnaround ECO Field Upgrade* for all its boards. CMD will *upgrade* the hardware of its board to a higher function for a charge of the difference of list prices of the original and upgraded functions. CMD will also update its board to its latest firmware release at no charge to the customer. Boards will be upgraded/updated and returned to the customer within 15 working days from the date of return to CMD.
- CMD also offers *24 hour turnaround loaner service* as stated in "RETURN FOR REPAIR."
- The remaining warranty period shall apply to the updated board. For upgraded boards, CMD will extend warranty for a period of six months.

Out-of-Warranty (More than 1 year)

- CMD offers a *15 working day turnaround different function upgrade service* for boards that can be upgraded to a higher function at a charge of the difference of list prices of two functions. CMD also offers a *free 15 working day turnaround ECO Field Upgrade* for all its boards. Boards will be upgraded/updated and returned to customer within 15 working days from the date of return to CMD.
- CMD also offers *24 hours turnaround Loaner Service* as stated in "RETURN FOR REPAIR."
- There will be no warranty extension for same function firmware update. For different function Hardware upgrade, CMD will extend warranty for a period of six (6) months.

Drive—same as in "RETURN FOR REPAIR."

SHIPPING CHARGES

The following shipping charges apply to all REPAIR, SWAP, LOANER, and UPGRADE UNITS.

In-Warranty

- Domestic - freight from CMD to customer is to be paid by CMD; freight from customer to CMD is to be paid by customer.
- International - all fees are to be paid by customer (including custom duty and broker fees).

Out-of Warranty

- Domestic - all fees are to be paid by customer.
- International - all fees are to be paid by customer (including custom duty and broker fees).

GENERAL CONDITIONS

All goods returned to CMD including returns for credit, swap returns, loaner returns, and evaluation returns shall remain in good condition. Any damage or alteration done by the customer will result in a rejection or additional charge to the customer.

Customer needs to talk to CMD Technical Support personnel to authorize returns of CMD Host Adapter for not functional upon arrival boards and swap requests. CMD Sales personnel must be consulted for the authorization of returning goods for credit and/or evaluation return.

Warranty

BASIC WARRANTY - In the absence of any optional warranty or continuing provisions by formal agreement, CMD warrants its products in accordance with the schedules listed below. Purchaser hereafter mentioned refers at all times to the customer who purchased CMD product(s).

HOST ADAPTER WARRANTY - CMD warrants Host Adapter products of its manufacture to be free from defect in material and workmanship for a period of one year from the date of shipment. During this period, if the customer experiences difficulties with a CMD Host Adapter and is unable to resolve the problem via phone with CMD Technical Support, a Return Material Authorization (RMA) will be issued. Following receipt of an RMA, the Purchaser is responsible for returning the product to CMD, freight prepaid. CMD, upon verification of warranty, will repair or replace at its option the Host Adapter in question, and will then return the product to the Purchaser, freight prepaid.

CABLE WARRANTY - All CMD provided cables are warranted for ninety (90) days from the time of shipment. Questionable cables should be returned to CMD, freight prepaid, where they will be repaired or replaced by CMD at its option and returned to the Purchaser, freight prepaid.

GENERAL TERMS - The above warranties shall not apply to expendable components such as fuses, bulbs, and the like, nor to connectors, adapters, and other items not a part of the basic product. CMD shall have no obligation to make repairs or to cause replacement required through normal wear and tear or necessitated in whole or in part by catastrophe, fault or negligence of the user, improper or unauthorized use of the product, or use of the product in such a manner for which it was not designed, or by causes external to the product, such as, but not limited to, power failure or air conditioning. CMD's sole obligation hereunder shall be to repair or replace any defective product, and, unless stated, pay return transportation costs within the United States of America for such replacement. Purchaser shall provide labor for removal of the defective product, shipping charges for return to CMD and installation of its replacement. On-site services are not a part of this warranty. Above warranties are subject to change without notice.

RETURNED MATERIAL - Warranty claims must be received by CMD within the applicable warranty period. A replaced product, or part thereof, shall become the property of CMD and shall be returned to CMD at Purchaser's expense. All returned material must be accompanied by a Return Materials Authorization (RMA) number assigned by CMD. For RMA numbers, call CMD at (714) 454-0800.

THE EXPRESSED WARRANTIES SET FORTH IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH OTHER WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED BY CMD. THESE STANDARD EXPRESS WARRANTIES ARE IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF CMD FOR DAMAGES, INCLUDING BUT NOT LIMITED TO SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THE PRODUCT.

Return and Repair Policy

WARRANTY PERIOD

The following warranty period is from the date of shipment:

CMD Host Adapter	one year
Cable	90 days
Drive	manufacturer's warranty

RETURN FOR CREDIT

The allowable period of return for credit from the date of shipment is as follows

CMD Host Adapter	less than 90 days
Cable	less than 60 days
Drive	not applicable

RETURN FOR REPAIR

CMD Host Adapter

In-Warranty (Less then 1 year)

- CMD offers a *15 working day turnaround repair service* at the cost of parts only. Defective boards will be repaired and returned to the customer within 15 working days from the date of return to CMD.
- CMD also offers two *In-Warranty 24 hour expediting services:*

24 Hour Turnaround Loaner Service:

Under this policy, CMD will ship a loaner in 24 hours during regular working days to the customer for a charge of $100.00 per loaner. Upon receiving the loaner, customer must return the defective board to CMD within seven (7) days for repair. CMD will repair the defective board and return the board to the customer. Customer must then return the loaner in seven (7) days after the receipt of the repaired board. Approval for loaner service is based on credit verification.

24 Hour Turnaround Swap Service:

In the case that the defective board is within the first six (6) months of the warranty, CMD, at its own option, offers a 24 hour turnaround swap service. CMD will ship the same model of the board to customer within 24 hours during working days in exchange for the defective board. CMD will swap with a new board if board is not functional upon arrival. For all other cases, swap will occur with either a new or refurbished board for a charge of $200.00. CMD does not offer swap services for boards that are purchased more than six months from the date of shipment. Customer is respon-

Appendix 2 Operating Systems Supported by CDU-720

All DEC-compatible products designed by CMD Technology, Inc. implement MSCP (Mass Storage Control Protocol) / TMSCP (Tape Mass Storage Control Protocol). CMD supports its implementation of MSCP/TMSCP beginning with the indicated version of the following DEC operating systems.

Operating Systems	*Version*
VMS	4.0-5.4
Ultrix	1.2-3.2
Unix/Berkeley	4.2 & 4.3
RSX-11M	Disk 4.1-5.3 Tape 4.2-5.3
RSX-11M-Plus	3.0-4.3
RSTS/E	Disk 9.0-9.7 Tape 9.5-9.7
RT-11	Disk 5.1-5.4C Tape 5.4
DSM-11	3.3-4.1
ISM-11	3.4
TSX +	(See RT-11)
VAXELN	x.x
AT&T UNIX	System 5

Appendix 3 SCSI Devices Supported by CDU-720

Disk drives supported by CDU-720/M/TM SCSI host adapter:

~ indicates new qualified device.
# indicates device supporting multi-hosting

Magnetic disk drives:

SEAGATE	WREN-IV, WREN V, WREN VI #, SWIFT (3-1/2") SABRE 8", WREN VII #, ELITE (5400 RPM) ~#
CONNER PERIPHERALS	CP-3100, CP3200 ~
CITOH	YD-3042, YD3082
DEC	RZ23 ~, RZ24 ~, RZ56 ~, RZ57 ~
FUJITSU	M2246SA Series, M2263SA ~#
HITACHI	DK515C Series #, DK516C ~
HP	97548S/D series
IBM	320 MB, 3-1/2"
MAXTOR	XT-4000S Series, XT-8000S Series
MICROPOLIS	1588-15 ~#
QUANTUM	ProDrive 40S/80S
TEAC	FD235HF (3-1/2" FLOPPY, DEC RX33 compatible) ~

More disk drives will be qualified soon.

Erasable Optical disk drives:

MAXOPTICS	Tahiti	Magneto optical disk
SONY	SMO-D501 #	Magneto optical disk
RICOH	RO-5030E, RO-5030E2	Magneto optical disk ~

Erasable Optical disk cartridge manufacturers:

SONY, RICOH, MAXOPTICS, PDO, 3M.

CD ROM disk drives:

DEC	RRD40 RRD50
LMS	CM210, CM212
TOSHIBA	XM3200 series

WORM drives:

1. with Ten X Technology Optical Convertion Unit

MAXTOR	RXT-800S, Rev. J, K
LMSI	LD510, LD1200
MITSUBISHI	MW-5U1
PIONEER	DD-55001 etc.

2. with LASERDRIVE interface

LASERDRIVE	Model 800 series

Tape drives supported by CDU-720/T/TM SCSI host adapter:

~ indicates new qualified device.
# indicates device supporting multi-hosting

1. 8mm helical scan tape drives

EXABYTE	EXB-8200 # 8mm helical scan

2. 4mm helical scan tape drives (Digital Audio Tape)

Archive	Python 4520 DAT #
GIGATREND	1200 series DAT
HP	35450A DAT #
SONY	SDT-1000 DAT #
WangDat	1300-003 DAT #
Wangtek	6130FS DAT #

3. VHS helical scan tape drives

Digidata	~

4. IBM-3480 compatible 18-track cartridge tape drives

ASPEN	System 480
FUJITSU	M2480 series
LMS	Independence
Storage Tech	4280 series (model Summit)

5. 1/2" reel to reel tape drives

Cipher	F880-II
HP	Model 88780B
KENNEDY	Model 9612
M4 data	Model 9914 (Async mode only)

6. 1/2" TK50 compatible tape drives

DEC	TZ30

7. 1/2" cartridge tape drives

FUJITSU	M2452E

Jukeboxs supported by CDU-720/TMJ SCSI host adapter

~ indicates new qualified device.

1. Disk Jukebox

Hewlett-Packard	C1710A ~
IDE	7000 ~
Kodak	~
NKK	~

2. Tape Jukebox

Colorado Tech Designs	CTD/8L ~

Appendix 4 Disk CSR addresses supported by the CDU-720/M

CSR supported by CDU-720/M Disk only with the IC P72009A in U102:

W11	W12	W13	W14	W15	Address	PDP-11
1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1	772150
1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN	2	760334
1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN	3	760354
1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN	4	760374
2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN	5	760340
2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN	6	760344
2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN	7	760350
2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN	8	760360
1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN	9	760364
1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN	10	760370
1-2 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN	11	760400
1-2 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN	12	760404
2-3 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN	13	760410
2-3 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN	14	760414
2-3 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN	15	760420
2-3 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN	16	760424
1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN	17	760430
1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN	18	760434
1-2 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN	19	760440
1-2 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN	20	760444
2-3 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN	21	760450
2-3 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN	22	760454
2-3 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN	23	760460
2-3 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN	24	760464
1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN	25	760470
1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN	26	760474
1-2 IN	2-3 IN	1-2 IN	2-3 IN	2-3 IN	27	760500
1-2 IN	2-3 IN	2-3 IN	2-3 IN	2-3 IN	28	760504
2-3 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN	29	760510

Appendix 5 Tape CSR addresses supported by the CDU-720/T

CSR supported by CDU-720/T Tape Only with the IC P72010A in U102:

W12	W13	W14	W15	W16	Address	PDP-11
1-2 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN	1	774500
1-2 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN	2	760404
1-2 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN	3	760444
1-2 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN	4	760504
1-2 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN	5	760544
1-2 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN	6	760410
1-2 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN	7	760450
1-2 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN	8	760454
1-2 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN	9	760414
1-2 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN	10	760420
1-2 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN	11	760460
1-2 IN	2-3 IN	1-2 IN	2-3 IN	2-3 IN	12	760510
1-2 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN	13	760514
1-2 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN	14	760520
1-2 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN	15	760550
1-2 IN	2-3 IN	2-3 IN	2-3 IN	2-3 IN	16	760554
2-3 IN	1-2 IN	1-2 IN	1-2 IN	1-2 IN	17	760560
2-3 IN	1-2 IN	1-2 IN	1-2 IN	2-3 IN	18	760604
2-3 IN	1-2 IN	1-2 IN	2-3 IN	1-2 IN	19	760610
2-3 IN	1-2 IN	1-2 IN	2-3 IN	2-3 IN	20	760614
2-3 IN	1-2 IN	2-3 IN	1-2 IN	1-2 IN	21	760620
2-3 IN	1-2 IN	2-3 IN	1-2 IN	2-3 IN	22	760644
2-3 IN	1-2 IN	2-3 IN	2-3 IN	1-2 IN	23	760650
2-3 IN	1-2 IN	2-3 IN	2-3 IN	2-3 IN	24	760654
2-3 IN	2-3 IN	1-2 IN	1-2 IN	1-2 IN	25	760660
2-3 IN	2-3 IN	1-2 IN	1-2 IN	2-3 IN	26	760704
2-3 IN	2-3 IN	1-2 IN	2-3 IN	1-2 IN	27	760710
2-3 IN	2-3 IN	1-2 IN	2-3 IN	2-3 IN	28	760714
2-3 IN	2-3 IN	2-3 IN	1-2 IN	1-2 IN	29	760744
2-3 IN	2-3 IN	2-3 IN	1-2 IN	2-3 IN	30	760750
2-3 IN	2-3 IN	2-3 IN	2-3 IN	1-2 IN	31	760754

Appendix 6 Tape CSR addresses supported by the CDU-720/TM

CSR supported by CDU-720/TM Tape and Disk with the IC P72008A in U102:

W11	W12	W13	Address	PDP-11
1-2 IN	1-2 IN	1-2 IN	1	772150
1-2 IN	1-2 IN	2-3 IN	2	760334
1-2 IN	2-3 IN	1-2 IN	3	760354
1-2 IN	2-3 IN	2-3 IN	4	760374
2-3 IN	1-2 IN	1-2 IN	5	760340
2-3 IN	1-2 IN	2-3 IN	6	760344
2-3 IN	2-3 IN	1-2 IN	7	760350
2-3 IN	2-3 IN	2-3 IN	disable disk	

W14	W15	W16	Address	PDP-11
1-2 IN	1-2 IN	1-2 IN	1	774500
1-2 IN	1-2 IN	2-3 IN	2	760404
1-2 IN	2-3 IN	1-2 IN	3	760444
1-2 IN	2-3 IN	2-3 IN	4	760504
2-3 IN	1-2 IN	1-2 IN	5	760544
2-3 IN	1-2 IN	2-3 IN	6	760410
2-3 IN	2-3 IN	1-2 IN	7	760450
2-3 IN	2-3 IN	2-3 IN	disable tape	

Appendix 7 Proper Use of VMS SYSGEN Connect Statement

To properly use the CONNECT statement in the SYSGEN utility of VMS 5.0 and up, the following rules must be followed.

From either terminal mode or through a command file run the SYSGEN utility. It is recommended that SYCONFIG.COM be used if an automatic command file is used.

```
$ MC SYSGEN
SYSGEN>
```

Then issue the CONNECT statement under SYSGEN to connect the controller.

```
SYSGEN>CONNECT aaaa/ADAPTER=bbb/CSR=%Occcccccc/VECTOR=%Oddd/
       DRIVER=eeDRIVER
```

aaaa is the designation of the controller (no :) such as PTB0

bbb is the adapter number such as UB0 which can be found from the SYSGEN utility SHOW/CONFIG (the NEXUS number)

cccccccc is the CSR of the controller being added on the specified NEXUS preceeded by %O (letter O)

ddd is the VECTOR of the controller being added on the specified NEXUS preceeded by %O (letter O)

ee is the name of the driver for the controller being connected.

Then issue the next CONNECT statement under SYSGEN to connect the drive.

```
SYSGEN> CONNECT ffff/NOADAPTER/SYSIDHIGH=%Xgggg/SYSIDLOW=
        %Xhhhhhhhh/DRIVER=iiDRIVER
```

ffff is the designation of the drive (no :) such as MUB0

gggg is the SYSIDHIGH number which is 8000 plus the NEXUS number

hhhhhhhh is the SYSIDLOW number which can be obtained after the controller is connected by using the SYSGEN utility SHOW/UNIBUS. The newly attached controller will be seen at the CSR address previously specified followed by the SYSIDLOW number seen in (hhhhhhhh).

EXAMPLE: User wish to connect a tape drive to a MicroVAX 3300. This tape drive is the third MU: device to be added to the Q-bus. The AUTOCONNECT recommended CSR for this device will not be used but the CSR of 760444 will be used instead with a VECTOR of 340 on UB0.

```
$ MC SYSGEN

SYSGEN> SHOW/CONFIG

        System CSR and Vectors on 11-JAN-1990 10:43:47.59

Name: PUA  Units: 1  Nexus:0  (UBA)  CSR: 772150  Vector1 : 774 ...
Name: PTA  Units: 1  Nexus:0  (UBA)  CSR: 774500  Vector1 : 260 ...
Name: PUB  Units: 1  Nexus:0  (UBA)  CSR: 760334  Vector1 : 300 ...
Name: TXA  Units: 8  Nexus:0  (UBA)  CSR: 760500  Vector1 : 310 ...
                             |
Note the Nexus number -------|  for the specified bus.


SYSGEN> CONNECT PTC0/ADAPTER=UB0/CSR=%O760444/VECTOR=%O340/
        DRIVER=PUDRIVER


SYSGEN> SHOW/UNIBUS

Address 760444 (8002A924) responds with value 0020 (hex).
                          |
                          |
Note the SYSIDLOW ---  value.

Calculate the SYSIDHIGH value by adding 8000 to the nexus 0
(=8000).


SYSGEN> CONNECT MUC0/NOADAPTER/SYSIDHIGH=%X8000/SYSIDLOW=
        %X8002A924/DRIVER=TUDRIVER

SYSGEN> *EXIT* (CONTROL Z to exit)

$
```